REMARKS

The application has been reviewed in light of the Office Action dated November 4, 2006. Claims 1-35 were pending, with claims 4, 13, 21-23 and 34 having been withdrawn by the Patent Office from examination. By this Amendment, claim 1 has been amended to clarify the claimed subject matter, without narrowing a scope of the claim, and new claims 36 and 37 have been added. Accordingly, claims 1-37 are now pending, with claims 1, 8-10 and 15 being in independent form.

The title was objected to as purportedly not descriptive.

By this Amendment, the title has been amended. Withdrawal of the objection to the title is respectfully requested.

Claims 1-3, 5-12, 14-19, 24-33 and 35 were rejected under 35 U.S.C. § 102(e) as purportedly anticipated by U.S. Patent No. 6,748,749 (Tsuda '749).

Applicant has carefully considered the Examiner's comments and the cited art, and respectfully submits that independent claims 1, 8-10 and 15 are patentable over the cited art, for at least the following reasons.

This application relates to a magnetic resonance imaging (MRI) apparatus comprising a super-conducting magnet including a super-conducting coil circuit. Such MRI apparatuses are popularly used in open type MRI systems in which the examination space for laying a patient is open which enables interventional maneuvering, for example, to perform an operation or endoscopy examination while effecting an MRI examination.

However, conventional MRI systems utilizing a super-conducting magnet can often experience problems induced by electro-magnetic interference from any one or more of various sources in the system (magnetic flux variation by the gradient magnetic field and the high frequency

magnetic field caused) which affects the ability of the system to deliver high-quality images (see pages 3-4 of application). Applicant found through substantial investigation that a closed loop circuit is formed between on the one hand an external control circuit or an external monitor circuit to which, for example, sensor elements for measuring in-vessel environment (in particular, helium liquid level) and heater elements (for emergency demagnetization), and on the other hand the super-conducting coil circuit through electro-magnetic coupling, and that the electromagnetic coupling is sufficiently large such that when varying magnetic fluxes due to the gradient magnetic field and the high frequency magnetic field generated in association with the imaging operation in the MRI apparatus pass through the closed loop circuit, an induced current flows in the closed loop circuit (including the control circuit and the monitor circuit) to cause the circuit to erroneously operate and cause the super-conducting state of the super-conducting coil circuit to be broken.

Applicant devised various improvements directed to overcoming such problems. For example, applicant devised improved magnetic resonance imaging apparatuses comprising a super-conducting magnet and further including interrupting means (i) for interrupting formation of a closed loop circuit passing through the control circuit or the monitor circuit and the super-conducting coil circuit (claim 1 of present application), (ii) for preventing high frequency current induced by the gradient magnetic field coils or the high frequency magnetic field coils from flowing in from the control circuit or the monitor circuit to the super-conducting coil circuit (claim 10 of present application), and/or (iii) for interrupting noise current generated based on tomographic image measurement of the subject and of which means is disposed outside the super-conducting magnet while being inserted between the electrical circuit and the electrical element (claim 15 of present application).

In addition, Applicant devised improved super-conducting magnet devices comprising (a) means for electro-magnetically shielding the super-conducting coil from the outside of the vessel (claim 8 of present application), and/or (b) a terminal portion for connecting a heater element or a sensor element disposed in the vessel to an external circuit, and the terminal portion including means for forming a closed loop circuit including the external circuit, an outer wall of the vessel and a grounding point provided at the wall (claim 9 of present application).

Tsuda '749 proposes an open-type magnetic resonance imaging apparatus using a super conducting magnet with liquid helium monitoring system which is suitable for maintenance and management of liquid helium for the super conducting magnet. In the apparatus proposed by Tsuda '749, a filter circuit 15 is provided so as to minimize the influence of magnetic wave noises.

The use and function of the filter circuit 15 of Tsuda '749 and the interrupting means of claim 1 of the present application are totally different.

Tsuda '749, column 4, lines 23-34, states as follows:

> The MRI apparatus is further provided with drive power sources 4, 6 and 8 which drive the above referred to respective coils, a sequencer 9 which controls the operation timing of these drive power sources and a computer 10 which controls the device itself as well as processes the NMR signals to construct picture images. The above referred to units are disposed outside the magnetic wave shielding room 16, and the *drive power sources for the respective coils are connected to the respective corresponding coils in the magnetic field shielding room 16 via a filter circuit 15 so as to minimize the influence of magnetic wave noises.*

Tsuda '749, column 4, lines 23-34, states as follows:

> Further, in each of the upper and lower cryostats 17 and 18 a level sensor is assembled which measures respective amount of liquid helium and to the respective sensors a measurement circuit 23 is connected. ***Signals from the measurement circuit 23 are inputted to the sequencer 9 and the computer 10 via the filter circuit 15.***

The filter circuit 15 in Fig. 1 of Tsuda '749 is a (line) filter circuit which is disposed on a wall

of the shield room 16 and connects the gradient magnetic field coils 3, the radio frequency coils 5, the detection coil 7, the cryo cooler 21 and the measurement circuit 23 inside the shield room 16 with the gradient magnetic field coil drive power source 4, the radio frequency power amplifier 6, the radio frequency amplifying and detecting circuit 8, the drive unit 22 and the sequencer 9 outside the shield room 16. The (line) filter circuit 15 in the apparatus proposed by Tsuda '749, similar to the filer circuit 116 in Fig. 1 (and described on page 12) of the present application, is provided for preventing external noises from entering the shielded examination room, for minimizing possible influences due to electromagnetic noises from outside the shield room, and for interrupting and removing radio frequency noises existing in the surroundings (outside the shield room) and also caused by the apparatus itself located outside the shield room and for preventing the measurement system inside the shield room from receiving these noises.

Accordingly, the (line) filter 15 of Tsuda '749 is not intended for interrupting a possible formation of a closed loop circuit passing through the control circuit or the monitor circuit and the super-conducting coil circuit, as provided by the subject matter of claim 1 of the present application.

The interrupting means in the subject matter of claim 1 of the present application is for interrupting a possible formation of a closed loop circuit passing through the control circuit or the monitor circuit and the super-conducting coil circuit. More specifically, as discussed on pages 25-26 of the present application, the interrupting means is for substantially interrupting the formation of the closed loop circuit (for example, 501 in Fig. 4) with the internal circuit of the cryostats and the connection cables, such as for the liquid helium measurement unit 121 and emergency demagnetizing unit 120. Thereby, as discussed on page 26 of the present application, a possible flowing-in of the current induced in association with the imaging operation of the MRI apparatus

into the internal circuit is prevented and a stable operation of the super-conducting magnet can be ensured.

Tsuda '749 simply does not teach or suggest such an interrupting means.

Likewise, Tsuda '749 does not teach or suggest (a) means for electro-magnetically shielding the super-conducting coil from the outside of the vessel (claim 8 of present application), (b) a terminal portion for connecting a heater element or a sensor element disposed in the vessel to an external circuit, and the terminal portion including means for forming a closed loop circuit including the external circuit, an outer wall of the vessel and a grounding point provided at the wall (claim 9 of present application), (c) means for preventing high frequency current induced by the gradient magnetic field coils or the high frequency magnetic field coils from flowing in from the control circuit or the monitor circuit to the super-conducting coil circuit (claim 10 of present application), (d) means for interrupting noise current generated based on tomographic image measurement of the subject and of which means is disposed outside the super-conducting magnet while being inserted between the electrical circuit and the electrical element (claim 15 of present application).

In addition, it should be noted that this application and the invention claimed in this application are assigned to Hitachi Medical Corporation, Tokyo, Japan. The assignment of this application to Hitachi Medical Corporation, Tokyo, Japan has been recorded by the USPTO at Reel 16794, Frame 0890.

Tsuda '749 is assigned, like this application, to Hitachi Medical Corporation, Tokyo, Japan. Therefore, in accordance with 35 U.S.C. § 103(c), Tsuda '749, under 35 U.S.C. § 103, does not preclude patentability of the claims of this application.

Accordingly, for at least the above-stated reasons, Applicant respectfully submits that independent claims 1, 8-10 and 15, and the claims depending therefrom, are patentable over the cited art.

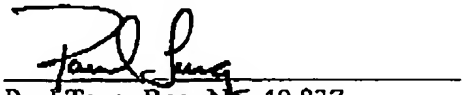
The Office Action indicates that claim 20 is objected to as being dependent upon a rejected base claim but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. However, since independent claim 15 from which claim 20 depends is submitted to be patentable over the cited art, no changes to the form of claim 20 is believed to be necessary.

In view of the remarks hereinabove, Applicant submits that the application is now in condition for allowance. Accordingly, Applicant earnestly solicits the allowance of the application.

If a petition for an extension of time is required to make this response timely, this paper should be considered to be such a petition. The Patent Office is hereby authorized to charge the additional claims fees and any additional fees that are required in connection with this amendment and to credit any overpayment to our Deposit Account No. 03-3125.

If a telephone interview could advance the prosecution of this application, the Examiner is respectfully requested to call the undersigned attorney.

Respectfully submitted,



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